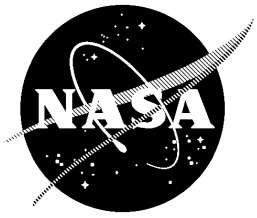
NETWORK AND MISSION SERVICES PROGRAMS

Demand Access System (DAS)
Systems Requirements Document

Original

15 October 2000



National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland

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Approved By:

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Roger Flaherty — Date
SN Project Manager
Code 451

_____

Tom Gitlin — Date
DAS Product Design Lead
Code 451

Goddard Space Flight Center
Greenbelt, Maryland

Preface

The purpose of this document is to provide the specification requirements for the Demand Access System (DAS) to be implemented at the White Sands Complex (WSC).

This document is under the configuration management of the Network and Mission Services Program Space Network (SN) Configuration Control Board (CCB).

This document may be updated by Documentation Control Notices (DCN) or revision.

Direct all comments, questions, or suggestions regarding this document to:

DAS Product Design Lead
Space Networks Project, Code 451
Goddard Space Flight Center
Greenbelt, Md. 20771

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Document Number	**Status/Issue**	**Publication Date**	**CCR Number**
451-SRD-DAS	Original	15 October 2000	

TBR LISTING

ID	Section	Requirement/ Description	
TBR-1	3.2.7.1.h	The DAS shall maintain system status log data for at least 45 days (TBR).	Prior to CDR
TBR-3	9.2.1.3.a	Second level maintenance actions shall include localization of a failure to the piece-part or equipment component level, as appropriate (TBR).	Prior to CDR

TBD LISTING

ID	Section	Requirement/ Description		
TBD-1	3.1.5.1.1.b	The DAS shall route CCSDS compatible return data. (TBD)		Prior to CDR
TBD-2 (was TBR-9)	3.2.1.a	The DAS shall report the results of a DAS Customer authorization check within 10 (TBR) seconds of the receipt of the logon request.		Prior to CDR
TBD-3	3.2.5.1.1.b	The DAS shall support frame sync based CCSDS protocol for routing data to Customers. (TBD)		Prior to CDR
TBD-4	11.0	Section 11. Security		Prior to CDR

DCN Control Sheet

DCN Number	Date/Time Group	Month/ Year	Section(s) Affected	Initials

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FIGURES

Section 1. Introduction

1.1 Background

The purpose of the Demand Access System (DAS) is to allow expansion of the Tracking and Data Relay Satellite System (TDRSS) Multiple Access Return (MAR) capabilities. The DAS will build on the Third Generation Multiple Access Beamformer Subsystem (TGBFS) development by adding demodulation functions, global system control and coordination functions and data distribution capabilities.

The existing Tracking and Data Relay Satellites (TDRSs) provide pre-scheduled communication services to Customers by using ground-based electronics to process signals emanating from Customers that are relayed by the TDRS MA on-board phased array antenna systems. The TGBFS allows expansion of services by using Element Multiplexer Correlators (EMCs). The TGBFS EMCs allow COTS Independent Beamforming Units (IBUs) to be connected to each EMC. The beamformers are then, in turn, connected to demodulators.

The use of the existing TGBFS equipment, the addition of IBUs and the addition of demodulators and system control functions will position the SN to better meet emerging customer needs.

DAS will be designed to support a variety of relatively low data rate Customers including low-earth orbiters, atmospheric and ground-based and support the following services: continuous, periodic, polling, formation flying, SOS, intermittent/on-demand.

1.2 Scope

This document addresses the operational, functional, performance, maintenance and installation requirements for the Demand Access System. The DAS, upon acceptance, will become part of the existing White Sands Complex. The White Sands Complex consists of the three ground terminals; the Second TDRSS Ground Terminal (STGT), the White Sands Ground Terminal (WSGT), and the Guam Remote Ground Terminal (GRGT).

1.3 Documents

The following documents are part of this specification to the extent cited therein. The most recent version of these documents takes precedence. If there are conflicts between the listed documents and the requirements of this specification, the requirements of this specification take precedence. If no section number is shown, the whole document applies.

1.3.1 Applicable Documents

Document Number	Document Title
530-WSC-LOP	The WSC Handbook Series, Volume Set
MIL-HDBK-217	Reliability Prediction of Electronic Equipment

MIL-STD-461	Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference
MIL-HDBK-470a	Designing and Developing Maintainable Products and Systems
STDN No. 270.5	GSFC Specification Electronic Equipment Racks
STDN 507	Networks Logistics Manual
STDN-SPEC-3	Specification Programming and Handling Semiconductor Devices
STDN-SPEC-4	GSFC General Requirements for STDN Electronic Equipment
STDN-SPEC-6	GSFC Specification Installation Requirements for STDN Equipment
STDN-SPEC-8	GSFC General Requirements for STDN Electronic
STDN-SPEC-10	Specification Station Handbook Documentation
500-tip-2111	Content Specification for Operation and Maintenance Manuals
451-PN Codes-SNIP	Space Network Interoperable PN Code Libraries
451-ICD-DAS/Customer	Interface Control Document between the Demand Access System and the Demand Access System Customers
451-ICD-DAS/WSC	Interface Control Document between the Demand Access System and the White Sands Complex
451-ICD-DAS/SWSI	Interface Control Document between the Demand Access System and the Space Network Web Services Interface
451-OCD-DAS	Demand Access System (DAS) Operations Concept Document
STGT-HE-04-04	USS RF Equipment Group HWCI Specification (HWCI No. 4), Section 3.3.4

530-WSC-0024	Information Technology Systems Security Plan (ITSSP) for the WSC
NPG 2810.1	NASA Procedures and Guidelines Security of Information Technology for Mission Information

1.3.2 Reference Documents

Document Number	Document Title
530-RSD-WSC	The Requirements Specification for the White Sands Complex (WSC)
033-140767	Third Generation Beamforming System (TGBFS) Requirements Specification
530-SNUG	Space Network User's Guide
ISO	International Standards Organization (ISO) Open System Interconnection (OSI) Reference Model
STGT-HE-04-10	HWCI Specification (HWCI No. 10)
290-003	IP Operational Network (IOnet) Security Plan
290-004	IP Operational Network (IOnet) Access Protection Policy and Requirements Document
452-SP-SWSI	Security Plan for SWSI
530-WSC-0009	WSC Security Manual

Section 2. DAS Reference Architecture

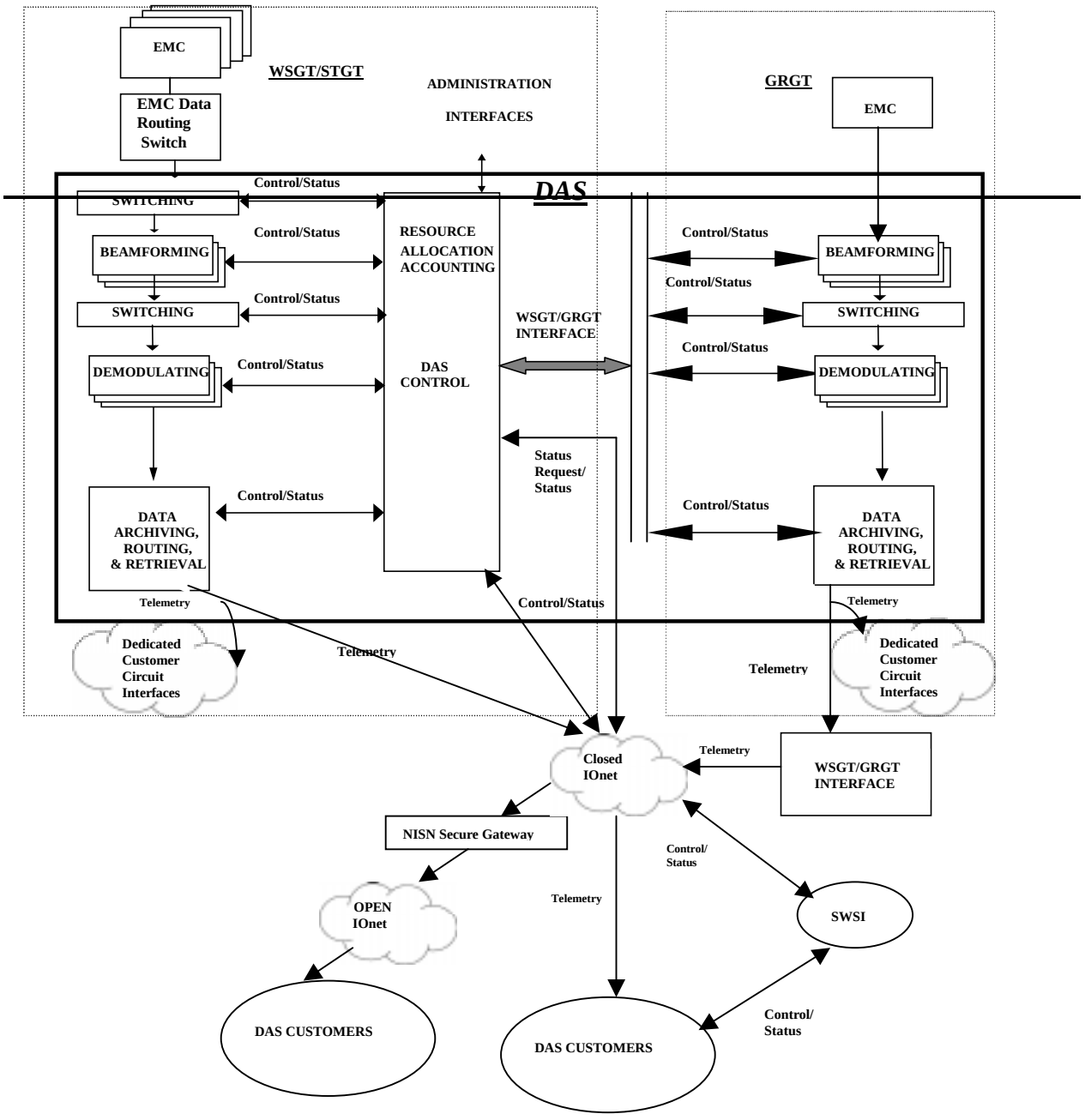
2.1 DAS Operations Summary

The DAS Operations are as described in the DAS Operations Concept Document.

2.2 DAS Reference Architecture

The DAS Reference Architecture is seen below. The reference architecture is subject to change based on factors that may arise during development.

Figure 2-1 DAS Reference Architecture



Section 3. System Requirements

3.1 Functional Requirements

The purpose of the DAS is to allow a DAS Customer to request resource allocations that will result in the establishment of MA return data through the TDRSS from the Customer's emitter(s). DAS Customers will be capable of requesting resource allocation planning information from the DAS for use in making resource allocation request decisions. Accepted DAS Customer resource allocation requests will result in the automatic management of beamforming, demodulation, and return data distribution capabilities on the part of the DAS. The top-level system functions for the DAS are to:

- Provide for DAS Customers to request MA return resource allocations via an automated interface,
- Provide automated management capability to allocate MA return resources,
- Provide a beamforming capability,
- Provide a signal demodulation capability,
- Provide a data archival, retrieval, and distribution capability, and
- Support a WSC System Interface.

3.1.1 Customer Interactions Management

The purpose of this function is to provide DAS Customers with automated interaction capabilities that will authorize them to provide resource allocation requests to the DAS and to receive resource allocation reports from the DAS.

Requirements:

3.1.1.a The DAS shall process DAS Customer system access identification information as part of DAS logon procedures.

3.1.1.1 Customer Resource Configuration Management

The purpose of this function is to provide the DAS Customer with the capability of entering, storing, updating, and retrieving constant parameters that are included routinely in requests for resource allocations. The capability to automatically retrieve and attach this information to a resource allocation request will also be provided by this function.

Requirements:

3.1.1.1.a The DAS shall accept DAS Customer set(s) of resource configuration parameters.

3.1.1.1.b The DAS shall accept updates to existing sets of DAS Customer configuration parameters.

3.1.1.1.c The DAS shall report to DAS Customers the contents of the configuration parameters currently retained.

3.1.2 Resource Management

The purpose of this function is to provide automatic management of MA return resource allocations based on DAS Customer requests for planning information and resources. In order to support the automated management of resources, this function determines resource availability times, manages DAS Customer and TDRS vector data, determines Customer emitter/TDRS visibility opportunities, assesses resource status of allocated resources, and reports the status to the DAS Customer and the DAS Local Control and Monitor.

The two types of DAS Customers that will be accommodated are:

Dedicated Customers - Customers guaranteed requested support from the shared set of DAS resources, and
Non-Dedicated Customers - Customers receiving first come, first serve support from the remaining set of shared resources after allocations have been made to support Dedicated Customers.

3.1.2.1 Resource Status Assessment

The purpose of this function is to automatically assess, log and report resource allocation status for a specific DAS Customer. The status report will be summarized to provide status as it applies to the implementation of a specific resource allocation

Requirements:

3.1.2.1.a The DAS shall collect and log status on each DAS Customer's allocated resources.

3.1.2.1.b The DAS shall provide periodic, unsolicited summarized resource allocation status reports to each DAS Customer.

3.1.2.1.c The DAS shall provide periodic, unsolicited summarized resource allocation status reports to the DAS LCM.

3.1.2.2 Resource Availability Assessment

The purpose of this function is to provide resource availability assessments in response to resource allocation planning requests and resource allocation requests made by DAS Customers. The assessments are based on the combined automated emitter visibility and DAS assets availability analysis results.

Requirements

3.1.2.2.a The DAS shall accept DAS Customer requests for resource allocation planning information.

3.1.2.2.b The DAS shall provide resource allocation availability reports to a DAS Customer for planning such that specific resource allocation information of other Customers is not compromised.

3.1.2.2.c The DAS shall provide resource availability data to the DAS LCM.

3.1.2.2.1 Visibility Time Windows

The purpose of this function is to determine the times when the Earth does not occlude the view of a TDRS (as seen from a DAS Customer emitter). The time series associated with these non-occultation opportunities will be used to determine the time windows marking intervals of emitter/TDRS line-of-sight visibility.

Requirements:

3.1.2.2.1.a The DAS shall provide DAS Customers with the option of specifying which TDRS(s) is (are) to be used in resource allocation service request.

3.1.2.2.1.b The DAS shall verify the validity of the DAS Customer's requests for TDRS assignments based upon visibility.

3.1.2.2.1.c The DAS shall use ephemeris data to automatically determine the visibility status of a TDRS.

3.1.2.2.1.d The DAS shall automatically construct the time windows within a DAS Customer specified time interval in order to identify when a TDRS is visible to a DAS Customer's emitter.

3.1.2.2.2 Resource Allocation Options Determination

The purpose of this function is to automatically identify and determine the DAS resources that are available for allocation at any given time. The function will determine the time windows when the resources are available for assignment and the resources available for allocation based on combined line-of-site and resource availability temporal constraints

Requirements:

3.1.2.2.2.a The DAS shall automatically assess resource allocation data to determine the allocation status of all DAS resource assets.

3.1.2.2.2.b The DAS shall automatically identify which DAS resource assets are available for allocation at any given time.

3.1.2.2.2.c The DAS shall automatically construct the time windows within a DAS Customer specified time interval that identifies when DAS resource assets are available for allocation.

3.1.2.2.2.d All DAS resources shall be shared to fulfill allocation requests for dedicated and non-dedicated Customers

3.1.2.2.2.e The DAS shall automatically assess the availability of resources for non-dedicated Customers use based upon the resources that are available after fulfilling dedicated Customer requests.

3.1.2.2.2.f The DAS shall combine emitter visibility and resource assets availability information to determine allocations that meet a DAS Customer request.

3.1.2.2.2.g The DAS shall provide a report to the DAS Customer, which summarizes the times when planning request constraints can be realized.

3.1.2.3 DAS Resource Allocation

The purpose of this function is to assign DAS resource allocations in response to requests made by DAS Customers. The allocations are based on the combined TDRS to Customer visibility and resource availability analysis results.

3.1.2.3.1 Resource Assignment

The purpose of this function is to automatically assign DAS resources from the beamforming, demodulation, and data distribution assets based upon Customer requests.

Requirements:

3.1.2.3.1.a The DAS shall accept DAS Customer requests for resource allocations.

3.1.2.3.1.b The DAS shall automatically allocate resources for the DAS Customers who request resource.

3.1.2.3.1.c The DAS shall ensure that the allocation of resources for Non-Dedicated Customers is never in conflict with the allocation of resources for Dedicated Customers.

3.1.2.3.1.d The DAS shall automatically assign resources from the shared pool of DAS resources to non-dedicated Customers when the resources are not required to fulfill dedicated Customers requests.

3.1.2.3.1.e The DAS shall automatically assign TDRS satellite(s) to a resource allocation request if no specific TDRS satellite(s) is (are) designated in the DAS Customer's request.

3.1.2.3.1.f The DAS shall log the resource allocation time intervals for each DAS asset.

3.1.2.3.1.g The DAS shall automatically make TDRS to TDRS transition assessments that will occur during a service as needed to support the assigning of DAS assets to satisfy each DAS Customer resource allocation request.

3.1.2.3.1.h The DAS shall provide status to the DAS Customer that reports the action taken as a result of the processing of resource allocation request.

3.1.2.3.1.i The DAS shall log resource assignment statistics as service accounting data.

3.1.2.3.1.j The DAS shall support assignment of demodulated signals from multiple emitters in the same beam.

3.1.2.3.1.k The DAS shall provide resource assignment data to the DAS LCM.

3.1.2.3.1.l The DAS shall notify the DAS Customer of any change to a resource allocation request that prevents the DAS Customer request from being supported.

3.1.2.3.1.m. The DAS shall be capable of removing from the DAS shared resources any resources that are unavailable due to failure or maintenance action.

3.1.2.3.2 Resource Assignment Modification

The purpose of this function is to allow a DAS Customer to modify (reconfigure or delete) a pending or an on-going request.

Requirements:

3.1.2.3.2.a The DAS shall ensure that a DAS Customer is restricted from modifying requests submitted by other DAS Customers.

3.1.2.3.2.b The DAS shall allow a DAS Customer to modify an accepted request that is pending implementation.

3.1.2.3.2.c The DAS shall allow a DAS Customer to modify an on-going request.

3.1.2.3.2.d The DAS shall provide status to the DAS Customer that reports the action taken as the result of the processing of modification requests.

3.1.2.3.2.e The DAS shall return DAS allocated assets to the pool of unallocated resources if no longer needed to support Customer resource allocation assignments.

3.1.2.3.2.f The DAS shall log the modification of resource assignments.

3.1.2.4 Vector Data Management

The purpose of this function is to automatically manage TDRS and DAS Customer vector data. Ephemeris generation, storage, and removal using TDRS and DAS Customer state vectors are the major capabilities associated with this function.

3.1.2.4.1 TDRS Ephemerides Generation

The purpose of this function is to automatically generate TDRS ephemeris from WSC System supplied TDRS state vectors.

Requirements:

3.1.2.4.1.a The DAS shall automatically accept TDRS vector data in accordance with the ICD between the DAS and the WSC, 451-ICD-DAS/WSC.

3.1.2.4.1.b The DAS shall support manual entry of TDRS vector data via the DAS LCM.

3.1.2.4.1.c The DAS shall notify Local Control and Monitor when a TDRS state vector update is overdue.

3.1.2.4.1.d The DAS shall propagate the last state vector in the existing TDRS ephemeris if a new state vector update is not available.

3.1.2.4.1.e The DAS shall automatically log TDRS ephemeris.

3.1.2.4.2 Customer Ephemeris Generation

The purpose of this function is to automatically generate DAS Customer emitter ephemeris from DAS Customer supplied emitter Type 1 (on-orbit) and Type 8 (stationary) state vectors.

Requirements:

3.1.2.4.2.a The DAS shall automatically accept DAS Customer emitter vector data.

3.1.2.4.2.b The DAS shall support manual entry of DAS Customer emitter vector data via the DAS LCM.

3.1.2.4.2.c The DAS shall automatically access an ephemeris for each DAS Customer emitter during resource allocation assessments.

3.1.2.4.2.d The DAS shall automatically log an orbiting DAS Customer emitter ephemeris.

3.1.2.4.2.e The DAS shall notify a DAS Customer and the DAS LCM when a DAS Customer state vector update is overdue.

3.1.2.4.2.f The DAS shall propagate the last state vector in the existing DAS Customer ephemeris if a new state vector update is not available.

3.1.2.4.2.g The DAS shall retain Type 8 vector data.

3.1.2.4.2.h The DAS shall generate an alert to the DAS LCM when TDRS or DAS Customer state vector updates are overdue.

3.1.2.4.3 Outdated Ephemerides Processing

The purpose of this function is to automatically remove outdated TDRS and DAS Customer emitter ephemerides.

Requirements:

3.1.2.4.3.a The DAS shall automatically identify outdated ephemerides.

3.1.2.4.3.b. The DAS shall automatically purge all outdated ephemerides.

3.1.3 MAR Beamforming

The purpose of this function is to automatically manage the MA beamformers. In addition, this function performs beamforming and reports status of the beamformers.

3.1.3.1 Beamforming

The purpose of this function is to weight and sum element signals to form a beam focused at the specified location based on service request.

To mitigate interference, the DAS will place nulls (or reduced gain) in the direction of interference signals, while still maintaining specified beamforming gain towards the desired Customer. In adaptive nulling the DAS will automatically detect interference and form appropriate nulls.

Requirements:

3.1.3.1.a The DAS beamformer shall receive the output of the existing WSC System MA System Element Multiplexer Correlator (EMC) in accordance with the ICD between the DAS and the WSC, 451-ICD-DAS/WSC.

3.1.3.1.b The DAS shall support the Pointing beamforming modes.

3.1.3.1.c The DAS shall support the Adaptive beamforming mode.

3.1.3.1.d The DAS shall support the Fixed Weight beamforming mode.

3.1.3.1.e The DAS interface from the EMC to the beamformer(s) shall support one-to-one and one-to-many connections.

3.1.3.1.f The DAS beamformer(s) shall switch between EMC output(s).

3.1.3.1.g The DAS shall weight and sum signals from selected EMC(s).

3.1.3.1.h The DAS shall output the weighted-sum signal(s).

3.1.3.1.i The DAS shall switch out any of the element channels upon request.

3.1.3.1.j The DAS shall automatically null interfering signals, when in adaptive nulling mode.

3.1.4 Signal Demodulation

The purpose of this function is to receive the formed MAR beams and demodulate selected Customer data bearing signals within the formed MAR beams.

3.1.4.1 Demodulation Selection

The purpose of this function is to receive the formed MAR beams and make the necessary connections between formed MAR beams and demodulators.

Requirements:

3.1.4.1.a The demodulator interfaces to the beamformer shall be one-to-one and one-to-many.

3.1.4.2 Demodulation

The purpose of this function is to receive a formed beam and Customer return data from the Customer signal contained within the signal.

3.1.4.2.1 Return Data Retrieval

The purpose of this function is to recover Customer baseband data.

Requirements:

3.1.4.2.1.a The DAS shall provide Doppler correction for Customer emitters.

3.1.4.2.1.b The DAS shall despread the received PN spread signal.

3.1.4.2.1.c The DAS shall demodulate the carrier.

3.1.4.2.1.d The DAS shall provide recovered carrier for Doppler measurement.

3.1.4.2.1.e The DAS shall recover symbol clock and detect the symbol.

3.1.4.2.1.f The DAS shall perform convolutional decoding on each baseband symbol stream.

3.1.4.2.1.g Deleted.

3.1.4.2.1.h The DAS shall resolve data phase ambiguity

3.1.4.2.1.i The DAS shall consider the Customer oscillator frequency uncertainty and signal dynamics when acquiring the Customer signal.

3.1.4.2.1.j Deleted

3.1.5 Return Data Distribution

The purpose of this function is to provide DAS Customers with MA return data distribution, archiving and retrieving capabilities.

3.1.5.1 Return Data Transmission

The purpose of this function is to provide the capability to route return data obtained in real-time or retrieved from the archive.

3.1.5.1.1 Return Data Formatting

Requirements:

3.1.5.1.1.a The DAS shall route serial, bit-stream contiguous return data.

3.1.5.1.1.b The DAS shall route CCSDS ~~compatible~~ data formatted return data. (TBD)

3.1.5.1.2 Return Data Routing

The purpose of this function is to determine real-time and archived data routing according to the destination(s) specified ~~provided~~ by DAS Customer requests for resource allocations.

Requirements:

3.1.5.1.2.a The DAS shall route Customer data to specified destination(s) in accordance with the ICD between the DAS and the DAS Customers, 451-ICD-DAS/Customers.

3.1.5.1.2.b The DAS shall route real-time MA return telemetry data to DAS Customer specified destination(s) via the NASA Integrated Services Network (NISN) Closed Internet Protocol (IP) Operational Network (IOnet) or dedicated Customer circuits.

3.1.5.1.2.c Deleted

3.1.5.1.2.d The DAS shall route retrieved archived MA return telemetry data to DAS Customer specified destination(s) via the NISN Closed IOnet or dedicated Customer circuits.

3.1.5.1.2.e Deleted

3.1.5.1.2.f Deleted

3.1.5.1.2.g The DAS shall route Customer serivce performance data to the DAS Customer specified destination(s) in accordance with the ICD between DAS and the SWSI, 451-ICD-DAS/SWSI.

3.1.5.1.3 Archived Return Data Retrieval

The purpose of this function is to retrieve the designated MA return data from archive at the times specified in DAS Customer requests for resource allocations.

Requirements:

3.1.5.1.3.a The DAS shall retrieve archived return data based on DAS Customer request.

3.1.5.1.3.b The DAS shall update the service accounting statistics with the return data retrieval statistics.

3.1.5.1.4 Return Data Transmission

The purpose of this function is to transmit MA telemetry data to DAS Customer destinations based on routing information.

Requirements:

3.1.5.1.4.a The DAS shall establish connection(s) with destination(s) to send return data.

3.1.5.1.4.b The DAS shall automatically re-establish a connection when the connection to a destination is severed.

3.1.5.1.4.c The DAS shall log the transmit status in the DAS Customer service accounting data.

3.1.5.1.4.d The DAS shall route realtime and archived return data to a DAS Customer simultaneously, if requested.

3.1.5.1.4.e The DAS shall manage the utilization of the GRGT-to-WSGT DAS allocated aggregate bandwidth to support real-time and archived retrieval supports.

3.1.5.1.4.f The DAS shall manage the utilization of the WSC DAS allocated aggregate bandwidth to support real-time and archived retrieval supports.

3.1.5.1.4.g The GRGT-to-WSC and WSC DAS allocated aggregate bandwidths shall be values that can be input and modified from the DAS LCM.

3.1.5.2 Return Data Archiving Management

The purpose of this function is to automatically manage the storage and removal of archived return data.

3.1.5.2.1 Return Data Storage

The purpose of this function is to archive the return data and to log the archiving event if designated to do so in the DAS Customer request specifications and to log the archiving event in the DAS Customer service accounting data.

Requirements:

3.1.5.2.1.a The DAS shall archive all real-time return data.

3.1.5.2.1.b The DAS shall maintain DAS Customer data for the retention duration requested by the DAS Customer as automated archive management parameters.

3.1.5.2.1.c The DAS shall update the resource usage statistics with the resource information, resource requested and time periods for archiving.

3.1.5.2.1.d The DAS shall log the storage statistics in the DAS Customer service accounting data.

3.1.5.2.2 Outdated Archived Data Purging

The purpose of this function is to automatically remove data that has exceeded its specified lifetime limit from the return data archive.

Requirements:

3.1.5.2.2.a The DAS shall have a defined maximum allowed storage duration.

3.1.5.2.2.b The DAS shall automatically remove archived data that has exceeded the limit based on the Customer data distribution specifications.

3.1.5.2.2.c The DAS shall automatically remove archived data that has exceeded the pre-set limits defined by configuration management.

3.1.5.2.2.d The DAS shall log the purge events in the DAS Customer service accounting data.

3.1.6 Local Control and Monitor (LCM)

The purpose of this function is to provide a local control and monitor interface to the DAS.

Requirements:

3.1.6.a The DAS LCM shall provide an operational interface to monitor, coordinate, control and report the performance of all DAS system components.

3.1.6.b The DAS shall accept system control commands from the DAS LCM.

3.1.6.c The DAS shall provide system control reports to the DAS LCM.

3.1.6.d The DAS shall accept system status requests from the DAS LCM.

3.1.6.e The DAS shall report system status to the DAS LCM.

3.1.6.f The DAS shall accept DAS Customer authorization parameters from the DAS LCM.

3.1.6.g The DAS shall report the current DAS Customer authorization parameters to the DAS LCM.

3.1.6.h The DAS shall accept requests for service accounting reports from the DAS LCM.

3.1.6.i The DAS shall support enabling and disabling adaptive nulling from the LCM.

3.1.7 Status

3.1.7.1 System Status

The purpose of this function is to collect and report system wide status of the hardware and software components that constitute the DAS.

Requirements:

3.1.7.1.a The DAS shall provide status of all components that constitute the DAS to the LCM.

3.1.7.1.b The DAS shall perform periodic and continuous statusing of all components that constitute DAS.

3.1.7.1.c The DAS shall log all status of all components that constitute DAS.

3.1.7.1.d The DAS shall support delogging of all collected status.

3.1.7.1e The DAS shall support printing of delogged status.

3.1.7.1.f The DAS shall indicate via an alert to the WSC TOCC when abnormalities are detected in DAS operations and resources.

3.1.7.1.g The DAS shall provide status indicators on the equipment front panels of all components that constitute DAS.

3.1.7.1.h The DAS shall provide DAS Customer performance status data to the LCM.

3.1.7.1.i The DAS shall indicate via an alert to the WSC TOCC a detection of an unauthorized entry attempt.

3.1.7.1.j The DAS shall support the disabling of status of any component that constitutes the DAS from the LCM.

3.1.7.1.k The DAS shall support acknowledgement of an alert, allowing the alert to be cleared even though the abnormality still exists, so that a recurrence of an abnormality results in a new alert.

3.1.7.2 Customer Performance Status

The purpose of this function is to collect and report performance status for Customer services.

Requirements:

3.1.7.2.a The DAS shall provide performance status data to the DAS Customer, if requested.

3.1.7.2.b The DAS shall report the DAS Customer receive frequency in the performance status data.

3.1.7.3 Service Accounting Reporting

The purpose of this function is to provide service accounting statistics on all DAS Customer services.

Requirements:

3.1.7.3.a The DAS shall provide service accounting statistics to the DAS LCM.

3.1.7.3.b The DAS shall allow the definition of a window for the service accounting statistics report to be input from the DAS LCM.

3.1.7.3.c The DAS shall report the duration of approved requests to the DAS LCM for the window specified.

3.1.7.3.d The DAS shall report the duration of actual DAS Customer supported events for the window specified.

3.1.7.3.e The DAS shall report the cumulative service accounting statistics for each DAS Customer for the window specified.

3.1.7.3.f The DAS shall report the cumulative service accounting statistics for each TDRS for the window specified.

3.1.7.3.g The DAS shall report the cumulative service accounting statistics for all DAS supported events for the window specified.

3.1.7.3.h The DAS shall support printing of the service accounting statistics report.

3.1.8 System Operations

3.1.8.1 DAS Operations Control

The purpose of this function is to provide automated startup and shutdown control of the DAS.

Requirements:

3.1.8.1.a The DAS shall place itself in a fully operational return data processing state in response to a system startup command.

3.1.8.1.b The DAS shall retain its current operational state resource allocation.

3.1.8.1.c After a restart operations command has been issued, the DAS shall restore service to its last operational state.

3.1.8.1.d The DAS shall report incremental status during the start up operations sequence to the DAS LCM.

3.1.8.1.e The DAS shall shutdown its operations in an orderly fashion in response to a system operations termination command.

3.1.8.1.f The DAS shall report incremental status during the shut down operations sequence to the DAS LCM.

3.1.8.1.g The DAS shall detect changes in the DAS internal configuration data to automatically adjust to changes in the system resources during normal operations.

3.1.8.2 System Resource Configuration Update

The purpose of this function is to allow DAS resources to be added to or removed from the shared pool of resources.

Requirements:

3.1.8.2.a The DAS shall support adding and removing DAS resources from the pool of shared resources from the DAS LCM

3.1.8.2.b The DAS shall change the allocation of resources assigned to the shared pool of resources without interrupting normal DAS operations.

3.1.8.3 Customer Data Update

The purpose of this function is to modify the DAS Customer identification data.

Requirements:

3.1.8.3.a The DAS shall allow only authorized personnel to access DAS Customer authorization data.

3.1.8.3.b The DAS shall retain Customer authorization data.

3.1.8.3.c The DAS shall allow authorized personnel to modify DAS Customer identification parameters without interrupting normal DAS operations.

3.1.8.3.d The DAS shall allow the addition of new DAS Customers without interrupting DAS operations.

3.1.8.3.e The DAS shall allow the deletion of existing DAS Customers without interrupting DAS operations.

3.1.8.3.f The DAS shall report the stored Customer authorization data to authorized personnel only.

3.1.9 Modular Expansion

Requirements

3.1.9.a The DAS implementation shall provide for modular expandability of beamformers.

3.1.9.b The DAS implementation shall provide for modular expandability of demodulators.

3.1.9.c The DAS implementation shall provide for modular expandability for archiving Customer data.

3.1.9.d The DAS implementation shall provide for modular expandability for routing Customer data.

3.1.9.e The DAS implementation shall provide for modular expandability for processing function.

3.2 Performance Requirements

3.2.1 Customer Interactions Management

Requirements

3.2.1.a The DAS shall report the results of a DAS Customer authorization check within 10 seconds of the receipt of the logon request. (TBD)

3.2.1.1 Customer Resource Configuration Management

Requirements

3.2.1.1.a The DAS shall permit each DAS Customer to simultaneously maintain up to 10 resource allocation configuration data sets.

3.2.2 Resource Management

3.2.2.1 Resource Status Assessment

Requirements

3.2.2.1.a The DAS shall automatically log resource allocation status at 1 minute intervals.

3.2.2.1.b The DAS shall automatically report resource allocation status at 1 minute intervals.

3.2.2.2 Resource Availability Assessment

3.2.2.2.1 Visibility Time Windows

Requirements

3.2.2.2.1.a The DAS shall assess visibility time windows at least 72 hours into the future for the time interval contained within a resource allocation request for a non-dedicated Customer.

3.2.2.2.1.b The DAS shall assess visibility time windows at least 24 hours greater than the windows computed in 3.2.2.2.1.a for the time interval contained within a resource allocation request for a dedicated Customer

3.2.2.2.2 Resource Allocation Options

Requirements

3.2.2.2.2.a The DAS shall assess resource allocation availability at least 72 hours into the future for the time interval contained within a resource allocation request.

3.2.2.3 DAS Resource Allocations

3.2.2.3.1 Resource Assignment

Requirements

3.2.2.3.1a When a Customer request is being supported by a single TDRS, DAS shall execute TDRS to TDRS transitions when the angle from zenith of the upcoming TDRS is equal to or smaller than the angle from zenith of the current TDRS as viewed from the DAS Customer satellite's center of mass.

3.2.2.3.1.b The DAS shall execute TDRS to TDRS transitions with no more than 15 seconds of service outage.

3.2.2.3.1.c The DAS shall provide status updates to the DAS Customers within 1 minute of a resource allocation change after commencement of service.

3.2.2.3.1.d The DAS shall reject resource allocation requests that are to be implemented within less than 2 minutes after the receipt of the request.

3.2.2.3.1.e The DAS shall notify the DAS Customer when the resource request is approved and which TDRS(s) will support the request, including any TDRS to TDRS transitions.

3.2.2.3.1.f The DAS shall notify the DAS Customer at the service start time of the inability to support an accepted request.

3.2.2.3.2 Resource Assignment Modification

Requirements

3.2.2.3.2.a The DAS shall implement allocation modification requests within 30 seconds of receipt of the request.

3.2.2.3.2.b The DAS shall reject resource allocation modifications within 1 minute prior to the time that the service is terminated.

3.2.2.4 Vector Data Management

3.2.2.4.1 TDRS Ephemerides Generation

Requirements

3.2.2.4.1.a The DAS shall maintain no more than 96 hours of propagated TDRS ephemerides.

3.2.2.4.2 Customer Ephemerides Generation

Requirements

3.2.2.4.2.a The DAS shall notify a DAS Customer 2 hours prior to the time that an ephemeris update is due if a state vector update has not been received.

3.2.2.4.2.b The DAS shall maintain no more than 96 hours of propagated DAS Customer ephemerides.

3.2.2.4.2.c DAS shall ensure that propagated ephemeris is available 2 minutes prior to the start of the DAS Customer requested support.

3.2.2.4.2.d DAS shall maintain Type 8 vector data indefinitely.

3.2.3 MAR Beamforming

3.2.3.1 Beamforming

Requirements

3.2.3.1.a The DAS shall form a beam such that the C/N_o of the formed beam is within 0.5 dB of the algebraic sum of the individual C/N_o's of the 30 element channels. (This assumes that the loss due to direction cosines inaccuracies is ≤ 0.05 dB, and the loss due to the EMC-provided calibration vector is ≤ 0.35 dB).

3.2.3.1.b The DAS shall generate weights such that the calculated transfer function (gain and phase) of the sum signal does not change as a result of the update, as long as the calibration vector is constant.

3.2.3.1c The DAS shall form simultaneous independent beams independently.

3.2.3.1.d The DAS shall have the capability of forming a beam centered at any commandable angle within a cone of 27° solid angle centered on the boresight of the TDRS MA antenna array.

3.2.3.1.e The DAS shall output an beamformed signal with an output signal level of –4 dBm ± 2.0 dBm for a nominal input signal level of -20 dBFS.

3.2.3.1.f The DAS shall output an beamformed signal that linearly follow the input signal level (within ± 0.5 dB) over the dynamic range of –12.3 dB to + 4 dB about the nominal input signal level of -20 dBFS.

3.2.3.1.g The DAS shall reestablish all Customer beams within 10 seconds following a loss and subsequent restoration of the EMC output signals.

3.2.3.1.h In adaptive beamforming mode, the DAS shall form a null on an interfering signal within 2 seconds from the time the covariance matrix 'containing' the interferer is provided to the DAS from the EMC.

3.2.3.1.i In adaptive beamforming mode, the DAS shall automatically null interfering signals by implementing an algorithm that maximizes the Customer signal to interference plus noise ratio in the 6 MHz channel bandwidth.

3.2.3.1.j In adaptive beamforming mode, for a single interferer having a level of 10 dB above the average element power and located outside the main lobe, the DAS shall null the interferer by at least 10 dB, for 95 percent of all possible combinations of main lobe positions and interferer locations for null locations which are fixed points on the surface of the earth.

3.2.3.1.k In adaptive beamforming mode, for a single interferer having a level of 10 dB above the average element power and located outside the main lobe, the DAS shall null the interferer by at least 10 dB, for 95 percent of all possible combinations of main lobe positions and interferer locations with the main lobe which is defined as a cone of 3° of solid angle, centered about the commanded pointing direction.

3.2.3.1.l In adaptive beamforming mode, the DAS shall update beam weights at a rate sufficient to maintain the required null depth while meeting the required beam quality, for maximum Customer to interferer angular velocities of 0.00033 radians per second.

3.2.3.1.m In adaptive beamforming mode, the adaptive nulling requirements shall apply to (Continuous Wave) CW interferers and to interferers of any spectral composition within the 6 MHz element channel bandwidth.

3.2.3.1.n In adaptive beamforming mode, beamforming requirements 3.2.3.1.a through 3.2.3.1.m shall apply during nulling, except for output C/No.

3.2.4 Signal Demodulation

3.2.4.1 Demodulation Selection

Requirements

3.2.4.1.a Each beamformer output shall be connected to any pre-assigned set of up to 16 demodulator inputs.

3.2.4.2 Demodulation

3.2.4.2.1 Return Data Retrieval

3.2.4.2.1.1 Signal Parameters:

Requirements

3.2.4.2.1.1.a The DAS shall support a return link signal with a Customer Emitter Frequency (F1) equal to the Customer Emitter Oscillator with a Customer Emitter oscillator frequency uncertainty as defined for Mode A and Mode B.

- Mode A denotes when the Customer Emitter oscillator frequency uncertainty is less than $\pm$ 700 Hz
- Mode B denotes the case when the uncertainty is less than $\pm$ 3 kHz.

3.2.4.2.1.1.b The DAS shall support a return link signal with PN Code Modulation of SQPN.

3.2.4.2.1.1.c The DAS shall support a return link signal with PN Chip Rate (Chips/Sec) of $\frac{31}{240 \times 96} \times F_1$

3.2.4.2.1.1.d The DAS shall support a return link signal with PN Code Length (Chips) of $2^{11} - 1$.

3.2.4.2.1.1.e The DAS shall support a return link signal with PN Code Epoch Reference in the I Channel equal to the Customer Emitter Oscillator.

3.2.4.2.1.1.f The DAS shall support a return link signal with PN Code Epoch Reference in the Q Channel equal to the Epoch delayed ½ PN Code Chip Period Relative to I Channel PN Code Epoch.

3.2.4.2.1.1.g The DAS shall support a return link signal with PN Code Family of Gold Codes, Per 451-PN Code-SNIP.

3.2.4.2.1.1.h The DAS shall support a return link signal with Symbol Format NRZ, and BIΦ-L. If the transmitted symbol format is NRZ to BIΦ-L converted, there will be no G2 inversion.

3.2.4.2.1.1.i The DAS shall support a return link signal with Data Format of NRZ-L, NRZ-M, and NRZ-S.

3.2.4.2.1.1.j The DAS shall support a return link signal with Data Modulation of Modulo-2 added asynchronously to PN Code on each Channel; SQPN

3.2.4.2.1.1.k The DAS shall support a total return link signal with a Data Rate Restriction of 1 – 300 kbps.

3.2.4.2.1.1.l The DAS shall support a return link signal with an I CHANNEL Data Rate Restriction of 1 – 150 kbps.

3.2.4.2.1.1.m The DAS shall support a return link signal with a Q CHANNEL Data Rate Restriction of 1 – 150 kbps.

- Data Signals on the I and Q Channels may be independent and asynchronous.
- If the I and Q channel data signals are independent, the sum of the data rates on the I and Q channel must not exceed 300 kb/sec.
- If the I and Q channel data signals are identical and synchronous (i.e., single data channel operations), the channel data rate must not exceed 150 kb/sec.

3.2.4.2.1.2 Input Signal Characteristics:

The signal characteristics of the received DAS signal are:

- Maximum received isotropic power (Customer signal plus Customer-to-TDRS AWGN) of –2.1 dBFS.
- Minimum received isotropic power (Customer signal plus Customer-to-TDRS AWGN) of 34.1 dBFS.
- Nominal received isotropic power (Customer signal plus Customer-to-TDRS AWGN) of –20 dBFS.

- The input signal contains pulsed RFI with pulse widths up to 5 µs and pulse amplitudes up to 10 dB above the average received power
- Frequency and PN chip rate signal dynamics will result from Customer spacecraft dynamics:
  $\dot{R}$ (Velocity) $\leq$ 12 km/sec,
  $\ddot{R}$ (Acceleration) $\leq$ 15 m/sec^2, and
  $\dddot{R}$ (Jerk) $\leq$ 0.02 m/sec^3

- The Phase Noise of the received DAS signal is:
  a) 1 Hz to 1 kHz $\leq$ 2.7° rms
  b) 1 kHz to 3 MHz $\leq$ 2.0° rms

- The data rate of the received DAS signal will be within 0.1% of the commanded data rate.

Requirements

3.2.4.2.1.2.a The DAS equipment shall not be damaged or cumulatively degraded by the input signal.

3.2.4.2.1.2.b The DAS shall not extend the effect of each pulse by more than 100 ns.

3.2.4.2.1.2.c The DAS shall provide for the operation of all signal processing functions, from EMC output to baseband, in the presence of pulsed RFI.

3.2.4.2.1.3 Input Signal Data Configurations:

Requirements

3.2.4.2.1.3.a The DAS shall process input signals for Single Data Channel configurations of Balanced QPSK; synchronous, identical, convolutionally coded data on each of the I and Q Channels.

3.2.4.2.1.3.b The DAS shall process input signals for Single Data Channel configurations of Unbalanced QPSK; synchronous, identical, convolutionally coded data on each of the I and Q Channels.

3.2.4.2.1.3.c The DAS shall process input signals for Single Data Channel configurations of BPSK; convolutionally coded data.

3.2.4.2.1.3.d The DAS shall process input signals for Dual Data Channel configurations of two independent convolutionally coded (rate 1/2) data signals, one on the I Channel and one on the Q Channel.

3.2.4.2.1.4 Decoding Requirements

Requirements

3.2.4.2.1.4.a The DAS shall decode a signal with a convolutional, non-systematic, transparent code.

3.2.4.2.1.4.b The DAS shall decode a signal with a rate of 1/2.

3.2.4.2.1.4.c The DAS shall decode a signal with a Constraint Length of K = 7.

3.2.4.2.1.4.d The DAS shall decode a signal with Generator Functions of G_1 = 1111001 and G_2 = 1011011.

3.2.4.2.1.4.e The DAS shall decode a signal with Symbols generated from G_1 that precede symbols generated from G_2 relative to the data bit period.

3.2.4.2.1.4.f The DAS shall decode a signal with Symbols generated from G_2 that are either true or complemented as defined by the service specifications.

3.2.4.2.1.5 Ambiguity Resolution

Requirements

Data Phase Ambiguity. Data Phase Ambiguity is the uncertainty that the logical sense of the data may be either true or complemented.

3.2.4.2.1.5.a The data phase ambiguity shall be resolved for all configurations and modes except when the data format is NRZ-L.

3.2.4.2.1.5.b Deleted

3.2.4.2.1.6 Probability of Error (P_E)

Probability of error performance (P_E) is defined as:

$$C/N_O = E_b/N_O + 10 \log R_b + L(P_E, R_b)$$

where:

- (C/N_O) = The formed beam C/No.
- P_E 10^{-5}
- R_b is the bit rate of the data channel.
- $L(P_E, R_b)$ is the allowable implementation loss.
- Implementation loss does not include beamforming loss.
- E_b/N_O is the theoretically required value for P_E in an Additive White Gaussian noise (AWGN) channel.

The performance requirements apply at the nominal input power levels defined in 3.2.4.2.1.2.

Requirements

3.2.4.2.1.6.a The $L(P_E, R_b)$ for an R_b of 1 kbps and P_E of 10^{-5} shall be 3.0 dB.

3.2.4.2.1.6.b The $L(P_E, R_b)$ for an R_b of 10 kbps and P_E of 10^{-5} shall be 3.0 dB.

3.2.4.2.1.6.c The $L(P_E, R_b)$ for an R_b of 100 kbps and P_E of 10^{-5} shall be 3.0 dB.

3.2.4.2.1.6.d The $L(P_E,R_b)$ for an R_b of 1 kbps and P_E of 10^{-6} shall be 3.2 dB.

3.2.4.2.1.6.e The $L(P_E,R_b)$ for an R_b of 10 kbps and P_E of 10^{-6} shall be 3.2 dB.

3.2.4.2.1.6.f The $L(P_E,R_b)$ for an R_b of 100 kbps and P_E of 10^{-6} shall be 3.2 dB.

3.2.4.2.1.6.g The $L(P_E,R_b)$ for an R_b of 1 kbps and P_E of 10^{-7} shall be 3.4 dB.

3.2.4.2.1.6.h The $L(P_E,R_b)$ for an R_b of 10 kbps and P_E of 10^{-7} shall be 3.4 dB.

3.2.4.2.1.6.i The $L(P_E,R_b)$ for an R_b of 100 kbps and P_E of 10^{-7} shall be 3.4 dB.

3.2.4.2.1.6.j For NRZ-M and NRZ-S data formats, an additional implementation loss of 0.1 dB shall be allowed.

3.2.4.2.1.6.k The specified performance shall be achieved for each data channel at the decoder output.

- The total element C/N_O is referenced at the DAS input and is defined as follows:

- QPSK; Dual Data Channel. The total element C/N_O is the sum of the I and Q Channel C/N_O's per element where the individual channel C/N_O's per element are each in accordance with the C/N_O formulation in 3.2.4.2.1.6.

- Balanced QPSK; Single Data Channel. The total element C/N_O is in accordance with the C/N_O formulation in 3.2.4.2.1.6.

- Unbalanced QPSK; Single Data Channel. The total element C/N_O is the sum of the I and Q Channel C/N_O's per element where only the strong channel C/N_O per element is in accordance with the C/N_O formulation in 3.2.4.2.1.6.

3.2.4.2.1.6.l For balanced QPSK; Single Data Channel, a maximum 0.1 dB additional implementation loss relative to requirements 3.2.4.2.1.6.a through 3.2.4.2.1.6.k shall be allowed.

3.2.4.2.1.6.m The specified performance shall be achieved after signal acquisition has been completed and signal tracking has been achieved.

3.2.4.2.1.6.n The specified performance shall be achieved in the presence of Additive White Gaussian Noise.

3.2.4.2.1.6.o The specified performance shall be achieved when the signals at the LNA input contain the signal characteristics of Paragraph 3.2.4.2.1.2.

3.2.4.2.1.7 Acquisition

For signal acquisition, the DAS will be provided with vectors describing the Customer emitter dynamics. The vector will have an epoch time uncertainty of $\leq \pm 9$ seconds.

Requirements

PN Code and Carrier Acquisition.

3.2.4.2.1.7.a Acquisition time shall be measured from the instant at which sufficient C/N_o (as defined in 3.2.4.2.1.7 b, c and d) is present at the DAS input

3.2.4.2.1.7.b Acquisition time shall include the time to acquire the PN code and carrier.

3.2.4.2.1.7.c The acquisition time shall not exceed 1 second for a C/N_O value of 36.0 dB-Hz for Mode A or the C/N_o required for the $P_E = 10^{-5}$, whichever is greater and the signal dynamics indicated in Section 3.2.4.2.1.2.

- Mode A is defined to be such that the received carrier frequency uncertainties due to Customer emitter transmitter uncertainties will not exceed $\pm$ 700 Hz.

- For the 1:1 I/Q Channel Power Ratio Mode, the sum of the I and Q Channel C/N_O's will be equal to the specified value. For the 1:4 I/Q Channel Power Ratio Mode, the Q Channel C/N_O

will be equal to the specified value. When one channel is absent such that the remaining channel is a BPSK signal, the C/N_O will be equal to the specified value.

3.2.4.2.1.7.d The acquisition time shall not exceed 3 seconds for a C/N_O value of 36.0 dB-Hz for Mode B or the C/N_o required for the $P_E = 10^{-5}$, whichever is greater and the signal dynamics indicated in Section 3.2.4.2.1.2.

- Mode B is defined to be such that the received carrier frequency uncertainties due to Customer emitter transmitter uncertainties will not exceed $\pm$ 3 kHz.

- For the 1:1 I/Q Channel Power Ratio Mode, the sum of the I and Q Channel C/N_O's will be equal to the specified value. For the 1:4 I/Q Channel Power Ratio Mode, the Q Channel C/N_O will be equal to the specified value. When one channel is absent such that the remaining channel is a BPSK signal, the C/N_O will be equal to the specified value.

3.2.4.2.1.7.e The probability of acquisition (P_{acq}) for the times specified in 3.2.4.2.1.7 b, c, and d shall be $\geq$ 0.9.

3.2.4.2.1.7.f In the event that acquisition does not occur within the time specified, the PN code shall be searched until acquisition occurs, or until the end of scheduled service.

The time to acquire includes time to search the PN code uncertainty.

3.2.4.2.1.8. Symbol/Decoder Synchronization.

Symbol/Decoder Synchronization time is measured from the time carrier acquisition is achieved to the time decoder synchronization is achieved. Decoder synchronization is achieved when the Viterbi decoder has selected and implemented the correct blocking of the input symbols (into groups of (G1, G2) symbol pairs). Requirements for bit error probability and symbol slipping take effect at the time decoder synchronization is achieved.

For the purposes of decoder synchronization, the minimum data bit transition density will be 64 randomly distributed data bit transitions within any sequence of 512 data bits with no more than 64 consecutive data bits without a transition.

Requirements

3.2.4.2.1.8.a For the minimum symbol and data transition densities and the minimum specified C/N_O values required for 10^{-5} P_E performance, the time to achieve symbol/decoder synchronization (in seconds) shall not exceed 1100/(data rate in bps), with 99% probability for Biphase symbol formats.

3.2.4.2.1.8.b For the minimum symbol and data transition densities and the minimum specified C/N_O values required for 10^{-5} P_E performance, the time to achieve symbol/decoder synchronization (in seconds) shall not exceed 6500/(data rate in bps), with 99% probability for NRZ symbol formats.

3.2.4.2.1.9 Bit Slippage

Requirements

3.2.4.2.1.9.a Normal Transition Density: The mean time between slips caused by a cycle slip in the symbol clock recovery loop shall be either no less than 90 minutes or no less than 10^{10} clock cycles, whichever is greater, for the C/N_O required for 10^{-5} P_E performance. This requirement applies for transition densities of at least 40% for NRZ symbols and any transition density for biphase symbols.

3.2.4.2.1.9.b Low Transition Density. The mean time between slips caused by a cycle slip in the symbol clock recovery loop shall be either no less than 90 minutes or no less than 10^{10} clock cycles, whichever is greater, for 1.0 dB more C/N_O than required for 10^{-5} P_E performance. This requirement applies for NRZ symbol transition densities between 25% and 40%.

3.2.4.2.1.10 Mean Time-to-Cycle Slip

Requirements

3.2.4.2.1.10.a The mean time-to-cycle slip in tracking the carrier shall be greater than or equal to 90 minutes for a 3 dB less C/N_O than required for 10^{-5} P_E performance.

3.2.4.2.1.11 False Acquisition

Requirements

3.2.4.2.1.11.a During signal acquisition and signal tracking, DAS services shall be protected against false carrier acquisition and false acquisition to PN code sidebands, including multipath.

- Multipath is defined as specular reflections with path delay > 700 nsec and < 5 msec, and < -6 dB with respect to the direct signal.

3.2.4.2.1.12 Loss of Symbol Synchronization

- For this requirement, maintenance of symbol synchronization is defined as a minimum mean time between symbol clock slips of 10^6 clock cycles.

Requirements

3.2.4.2.1.12.a Normal Transition Density. Symbol synchronization shall be maintained for 3 dB less C/N_O than required for 10^{-5} P_E performance. This requirement applies for transition densities of at least 40% for NRZ symbols and any transition density for biphase symbols.

3.2.4.2.1.12.b Low Transition Density. Symbol synchronization shall be maintained for 2 dB less C/N_O than required for 10^{-5} P_E performance. This requirement applies for NRZ symbol transition densities between 25% and 40%.

3.2.4.2.1.13 C/N_O Variation

Requirements

3.2.4.2.1.13.a The DAS shall accommodate an input C/N_O variation of 12 dB, at a rate not to

exceed 10 dB/sec, without requiring a reconfiguration.

3.2.4.2.1.14 Additional Signal Distortions

Requirements

3.2.4.2.1.14.a The DAS shall provide for operation of all signal processing functions from EMC output to baseband with an input signal containing the following additional distortion: Data asymmetry $\leq \pm 3\%$

3.2.4.2.1.14.b The DAS shall provide for operation of all signal processing functions from EMC output to baseband with an input signal containing the following additional distortion: Data transition time $\leq$ 5% of symbol.

3.2.4.2.1.14.c The DAS shall provide for operation of all signal processing functions from EMC output to baseband with an input signal containing the following additional distortion: I/Q data skew (relative to requirements for I/Q data synchronization) $\leq$ 3%

3.2.4.2.1.14.d The DAS shall provide for operation of all signal processing functions from EMC output to baseband with an input signal containing the following additional distortion: I/Q PN chip skew (relative to 0.50 chip) $\leq$ 0.01 chip

3.2.4.2.1.14.e The DAS shall provide for operation of all signal processing functions from EMC output to baseband with an input signal containing the following additional distortion: PN code power suppression < 0.3 dB

3.2.4.2.1.14.f The DAS shall provide for operation of all signal processing functions from EMC output to baseband with an input signal containing the following additional distortion: PN chip rate (relative to absolute coherence with carrier rate) $\leq$ 0.01 Hz at PN rate

3.2.4.2.1.14.g The DAS shall provide for operation of all signal processing functions from EMC output to baseband with an input signal containing the following additional distortion: BPSK phase imbalance $\leq \pm 3°$

3.2.4.2.1.14.h The DAS shall provide for operation of all signal processing functions from EMC output to baseband with an input signal containing the following additional distortion: Gain imbalance $\leq \pm$ 0.25 dB

3.2.4.2.1.14.i The DAS shall provide for operation of all signal processing functions from EMC output to baseband with an input signal containing the following additional distortion: QPSK phase imbalance $90 \pm 3°$

3.2.4.2.1.14.j The DAS shall provide for operation of all signal processing functions from EMC output to baseband with an input signal containing the following additional distortion: AM/PM $\leq$ 12°/dB

3.2.4.2.1.14.k The DAS shall provide for operation of all signal processing functions from EMC output to baseband with an input signal containing the following additional distortion: Spurious PM (100 Hz to 3 MHz) $\leq$ 3° rms

3.2.4.2.1.14.l The DAS shall provide for operation of all signal processing functions from EMC output to baseband with an input signal containing the following additional distortion: Incidental AM (3σ) (at frequencies > 10 Hz for data rates < 1 kbps; at frequencies > 100 Hz for data rates $\geq$ 1 kbps) $\leq$ 6%

3.2.4.2.1.15 Deleted

3.2.4.2.1.15 Deleted

3.2.4.2.1.16 Reacquisition

Requirements

3.2.4.2.1.16.a In the event of loss of lock (PN code and/or carrier) reacquisition shall be automatically initiated.

3.2.4.2.1.16.b The most recent commanded frequency offset shall be used to aid reacquisition.

3.2.4.2.1.16.c Reacquisition time shall be less than or equal to the initial acquisition times specified in Section 3.2.4.2.1.7.c and 3.2.4.2.1.7.d.

3.2.4.2.1.16.d Reacquisition shall continue until lock is achieved or DAS is reconfigured.

3.2.4.2.2 Deleted

3.2.4.2.2.a Deleted

3.2.4.2.2.b Deleted

3.2.4.2.2.c Deleted

3.2.4.2.2.d Deleted

3.2.4.2.2.e Deleted

3.2.4.2.2.f Deleted

3.2.5 Return Data Distribution

3.2.5.1 Deleted

3.2.5.1.a Deleted

3.2.5.1.1 Return Data Formatting

Requirements

3.2.5.1.1.a The DAS shall support Internet Protocol (IP) for routing data to Customers via Closed IOnet or dedicated Customer circuits.

3.2.5.1.1.b The DAS shall support frame sync based CCSDS protocol for routing data to Customers via Closed IOnet or dedicated Customer circuits. ~~(TBD)~~

3.2.5.1.1.c The DAS shall support routing serial, bit-stream contiguous data to Customers via dedicated Customer circuits.

3.2.5.1.1.d. The DAS shall support the IP Data Unit (IPDU) ground transport header for return CCSDS telemetry formats for routing data to Customers via Closed IOnet and dedicated Customer circuits.

3.2.5.1.1.e. The DAS shall support the Standard Formatted Data Unit (SFDU) ground transport header for return CCSDS telemetry formats for routing data to Customers via Closed IOnet and dedicated Customer circuits.

3.2.5.1.1.f. The DAS shall support the Low Earth Orbiting-Terminal (LEO-T) ground transport header for return CCSDS telemetry formats for routing data to Customers via Closed IOnet and dedicated Customer circuits.

x.x.x.x.x The DAS shall provide the capability to allow upgrades to support future CCSDS compatible telemetry formats.

3.2.5.1.2. Deleted

3.2.5.1.3. Archived Return Data Retrieval

Requirements

3.2.5.1.3.a The DAS shall respond to the retrieve archived return data request within 30 seconds.

3.2.5.1.3.b The DAS shall retrieve and transmit archived data within 1 minute of the specified time.

3.2.5.1.3.c The DAS shall reject archived data retrieval requests received within 1 minute of the request start time.

3.2.5.1.4 Return Data Transmission

Requirements

3.2.5.1.4.a The DAS shall transmit return data, within the WSC DAS allocated aggregate bandwidth, to a maximum of 50 DAS Customers simultaneously.

3.2.5.2 Return Data Archiving Management

3.2.5.2.1 Return Data Storage

Requirements

3.2.5.2.1.a The DAS shall provide no less than 100 Mbytes of storage space to archive return data.

3.2.5.2.1.b The DAS shall simultaneously manage archiving up to 50 return data streams.

3.2.5.2.1.c Archived data shall be overwritten on a first in, first out basis.

3.2.5.2.1.d Notification shall be provided to the DAS LCM when the archived storage device is 90 percent full.

3.2.6 Local Control and Monitor

Requirements:

3.2.6.a The DAS shall automatically provide status reports of all components that constitute DAS to the Local Control Monitor with a 5 second refresh rate.

3.2.7 Status

3.2.7.1 System Status

Requirements

3.2.7.1.a. DAS shall log status of all components that constitute DAS every 1 second.

3.2.7.1.b. DAS shall time stamp all delogged status outputs.

3.2.7.1.c. DAS shall allow delogging of status based on data value changes only.

3.2.7.1.d. DAS shall log an event alert when an operational abnormality occurs within 1 second of the occurrence of the abnormality.

3.2.7.1.e The DAS shall provide status of all components that constitute DAS on demand.

3.2.7.1.f The DAS shall provide DAS Customer performance status data to the LCM on demand.

3.2.7.1.g The DAS shall allow delogging of individual status measurands .

3.2.7.1.h The DAS shall maintain system status log data for at least 45 days (TBR).

3.2.7.2 Customer Performance Status

Requirements:

3.2.7.2.a The DAS shall provide performance status data to the DAS Customer at 1 minute intervals at the commencement of service.

3.2.7.3 Service Accounting Reporting

Requirements:

3.2.7.3.a The service accounting statistics report shall be available at the LCM within 1 minute of the submitted request.

3.2.8 Deleted

3.2.8.1 Deleted

3.2.8.2 Deleted

3.2.8.3 Deleted

3.2.9 Deleted

3.3 Interface Requirements

3.3.1 DAS-SWSI Interface

Requirements

3.3.1.a The DAS shall interface with the SN Web Services Interface (SWSI) in accordance with the specifications in the Interface Control Document between the Demand Access System and the Space Network Web Services Interface, 451-ICD-DAS/SWSI.

3.3.2 Not Used

3.3.3 DAS-Customer Interfaces

Requirements

3.3.3.a The DAS shall exchange information with DAS Customers in accordance with the specifications in the Interface Control Document between the Demand Access System and the Demand Access System Customers, 451-ICD-DAS/Customer.

3.3.3.b The DAS shall exchange information with DAS Customers in accordance with the specifications in the Interface Control Document between the Demand Access System and the Space Network Web Services Interface, 451-DAS/SWSI

3.3.4 DAS-WSC System Interface

Requirements

3.3.4.a The DAS shall interface with the WSC Systems in accordance with the specifications in the Interface Control Document between the Demand Access System and the White Sands Complex, 451-ICD-DAS/WSC.

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Section 4. Reliability, Maintainability, and Availability Requirements

This section specifies the reliability, maintainability, and availability (R/M/A) requirements for the DAS. Two categories of availability requirements are defined: inherent availability and operational availability.

4.1 Reliability

The measure of reliability for the DAS is the mean time between failures (MTBF). The MTBF is defined as the 10-year life cycle of a fully operational DAS divided by the predicted number of failures.

4.1.1 Mean Time Between Failures (MTBF)

The MTBF is determined in accordance with MIL-HDBK-217, Reliability Prediction of Electronic Equipment.

Requirements:

4.1.1.a The Parts Count Reliability prediction method of MIL-HDBK-217 shall be used in the initial stages of system design.

4.1.1.b The reliability prediction method shall shift to the Parts Stress Analysis Prediction method, or other reliability modeling technique approved by NASA, at the time when a firm, detailed parts list is available.

4.2 Maintainability

Maintainability is characterized by the mean time to repair (MTTR) and includes the corrective maintenance time but not logistics and administrative delays inherent to the maintenance process. Logistics delays include the time required to provide replacement units at the failure location (replacement units are available at the WSC). Administrative delays include the time required for maintenance personnel and test equipment to arrive at the failure location.

4.2.1 Mean time to repair (MTTR)

Mean time to repair (MTTR) as the measure of maintainability is defined as the sum of corrective maintenance times at any specific level of repair, divided by the total number of failures within an item repaired at that level, during a particular interval under stated conditions. The MTTR includes the maintenance times for the first level maintenance as defined by Section 9.2.1.2. Time that is required for second level maintenance as defined in Section 9.2.1.3 is not a part of MTTR.

Requirements:

4.2.1.a A Maintainability Status Report shall be provided in accordance with Task 104 of MIL

HDBK-470a, Designing and Developing Maintainable Products and Systems, and include any changes in predicted maintainability parameters.

4.2.1.b The DAS shall have an MTTR not exceeding 30 minutes during the expected 10 year lifetime of the DAS.

4.2.1.c The maximum time to repair shall not exceed 1 hour for the 90^{th} percentile of failures.

4.2.1.d These MTTRs shall be applicable to GRGT for components with locally available sparing.

4.2.2 Fault Isolation

To facilitate isolation of failures, a system of fault isolation will be provided which will meet the following requirements and constraints:

Requirements:

4.2.2.a. Failures shall be isolated to one chassis or Line Replaceable Unit (LRU), whichever is smaller. Manual intervention can be used to isolate failures to below the chassis or LRU level.

4.2.2.b. Modes shall be provided to enable the repeating and/or bypassing of tests to check the operation of the subsystems while using internal or external test equipment.

4.3 Inherent Availability (A_i)

Inherent availability (A_i) is the probability that a system or equipment, when used under stated conditions in an ideal support environment (i.e., using available tools, spares, and personnel) will operate within specifications at all times. It excludes preventive maintenance actions, logistics supply time, and administrative downtime and is defined as

$A_i = MTBF/(MTBF + MTTR)$

where MTBF = mean time between failures and MTTR = mean time to repair.

Requirements:

4.3.a The inherent availability for any period of 10,000 hours shall be 0.995.

4.4 Operational Availability (A_O)

The operational availability (A_O) of the DAS is defined in terms of each multiple access Customer service.

Requirements:

4.4.a For each DAS there shall be a communications path from the output of the EMC to the Data routing and Archiving external interface, such that the operational availability, measured over a 10,000 hour interval is 0.9999. Redundant paths may be used in achieving this Ao.

4.4.1 Operational Availability Computation

The computation of operational availability for DAS is defined as:

$$A_O = \frac{\text{Time Service is Available}}{\text{Time Service is Available + Time Service is Not Available}}$$

Requirements:

4.4.1.a Available service time is measured over a contiguous 10,000 hour interval except that any loss of availability due to loss of facility services such as power or air conditioning, or loss of system capability resulting from unusual weather conditions, such as icing or severe rain storms, shall not be counted.

4.4.1.b The time service is not available shall include all times service is not available due to corrective maintenance downtime, administrative downtime, logistics supply downtime, and preventive maintenance downtime.

Section 5. Equipment Design and Construction

This section specifies the general electrical and mechanical design and construction requirements for the chassis, subsystems and racks comprised by the DAS.

5.1 General Requirements for Electronic Equipment

5.1.1 Equipment of New Design or Significantly Modified Design

Requirements:

5.1.1.a All chassis, subsystems and systems of new design or significantly modified design shall be designed and constructed to comply with the requirements of STDN-SPEC-4, GSFC General Requirements for STDN Electronic Equipment, or best commercial practices.

5.1.1.b Section 3.16 of STDN-SPEC-4, Maintainability shall not apply.

5.1.1.c Maintainability provisions of this specification shall be used.

5.1.1.d Programmable semiconductor devices in any chassis shall be handled in accordance with the provisions of STDN-SPEC-3, Specification Programming and Handling Semiconductor Devices.

5.1.1.e Connectors, cable, wires and other materials listed in STDN-SPEC-8, GSFC Specification for Electronic Equipment Installation Materials shall be used in the design and construction of WSC equipment. Use of materials other than those in STDN-SPEC-8 will require a waiver from the DAS Product Design Lead.

5.2 Electronic Equipment Racks

Requirements:

5.2.a DAS equipment shall be mounted in electronic equipment racks which conform to STDN No. 270.5, GSFC Specification Electronic Equipment Racks.

5.2.b Tapped panel mounting holes shall be included (Section 6.8 of STDN No. 270.5).

5.2.c If required to meet the Electromagnetic Interference (EMI) requirements for the WSC, the Electromagnetic Compatibility option (Section 6.10 of STDN No. 270.5) shall be used where necessary.

5.2.d If racks in excess of the standard 19-inch panel width are required for mounting some equipment, Section 6.14 of STDN No. 270.5 shall apply.

5.2.e Equipment consoles shall comply with the requirements of Section 6.18 of STDN No. 270.5. If size constraints of standard equipment require console construction that differs from the requirements of Section 6.17, or if the contractor desires to use consoles which are not in compliance with Section 6.17 of STDN No. 270.5, then a waiver will be required from the DAS Product Design Lead.

5.3 Cabling and Connectors

Requirements:

5.3.a Each rack shall be provided with an input/output (bulkhead) panel in accordance with Section 3.7a of STDN-SPEC-4.

5.3.b All cabling between DAS delivered systems and subsystems and WSC Systems shall be provided.

5.3.c All mating connectors shall be supplied.

5.3.d All cabling required to configure the systems and subsystems for checkout and in-plant testing shall be provided. This includes cabling required at the WSGT/STGT and GRGT sites for all special test equipment.

5.4 Electromagnetic Interference (EMI)

Requirements:

5.4.a Deleted

5.4.b Deleted

5.4.c The operational convenience of the DAS shall be maintained while satisfying the above requirements by the exclusion of rack front doors, hidden controls and displays, and by the location of equipment in the system racks.

5.4.d EMI racks and filtering shall be used as required.

5.4.e All controls and displays shall be fully accessible during setup and normal operation of the DAS.

5.4.f DAS equipment shall not be effected by conducted or radiated emissions resulting from the operation of existing equipment.

5.4.g All DAS equipment shall comply with STGT-HE-04-04, USS RF Equipment Group HWCI Specification (HWCI No. 4) Section 3.3.4.2 for Electromagnetic Compatibility (EMC) Control.

5.4.h DAS equipment conducted and radiated emissions shall not effect existing equipment.

Section 6. Installation Requirements

This section specifies the requirements for the installation of the DAS equipment. The approach, methods, equipment, and schedules for planning, managing, performing, and monitoring the installation of the DAS equipment are specified.

6.1 Installation

6.1.1 Site Planning

Requirements:

6.1.1.a WSC-provided site documents shall be used in planning the configuration and layout of equipment.

6.1.1.b. A set of plans shall be developed that provides an efficient layout of all equipment.

6.1.1.c The site plan shall provide drawings that specify the type, size, length, number, and layout of conductors for all signal and power cabling necessary for equipment operation.

6.1.1.d The site plan shall contain, for each major component: the BTUs emitted; the electrical power requirements by KVA, Hertz, Volts and power conditioning; and the floor space area occupied by each rack or multiple rack system.

6.1.1.e The equipment installation shall be documented in accordance with the requirements of the WSC Handbook Series, Volume VII, Engineering, 530-WSC-LOP-VII and, the Specification Station Handbook Documentation, STDN-SPEC-10.

6.2 Site Preparation

The following services, which are required to prepare the sites for the installation and testing of the DAS, will be provided.
Requirements:

6.2.a All power and signal cables necessary for equipment operations shall be provided.

6.2.b Cable installation shall be in accordance with the requirements of STDN-SPEC-6, GSFC Specification Installation Requirements for STDN Equipment.

6.2.c All cable fabrication shall be in accordance with the requirements of STDN-SPEC-4, Section 3.7.

6.3 Equipment Installations

Requirements:

6.3.a Equipment installations shall be in accordance with STDN-SPEC-6, Installation Requirements for STDN Equipment

6.3.b Floor panels shall be in accordance with the requirements of STDN-SPEC-6.

Section 7. Documentation

7.1 Documentation

Requirements:

All documentation is to be developed in accordance with the Data Requirements List (DRL) and Data Item Descriptions (DIDs). The DRL lists each document to be provided and the DIDs describe the purpose, content and format of each document.

Section 8. Training

8.1 General

This section specifies the objectives and approach for the training of WSC personnel.
Requirements:

8.1.a Training policies, plans and procedures shall provide for orderly transition into sustained operations and maintenance.

8.2 Objectives and Approach

Requirements:

8.2.a Training shall prepare operations and maintenance personnel, including both Government and contractor employees, to operate, maintain, and support the DAS.

8.2.b Operations personnel shall be trained to perform operations functions in accordance with WSC Local Operations Procedures (LOPs) .

8.2.c Maintenance technicians shall be trained to maintain DAS subsystems in order to meet the maintainability requirements. This includes training in the maintenance of software and firmware using the facilities provided in the SMTF. The overall training objective is to provide certified and maintenance personnel.

8.2.d The maximum amount of training shall be performed at the WSC. Training shall be conducted at other sites, such as vendor facilities, when it is cost effective to the Government, e.g., to take advantage of existing courses and training facilities.

8.2.e The course material shall be modularized, individualized, and use multimedia learning resources including manuals, study guides, workbooks and audiovisual materials as appropriate.

8.2.f The initial training program shall concentrate on maintenance and operations.

8.2.g Students for further training programs shall include NASA instructors, cognizant NASA technical personnel, NASA system engineers and WSC Operations and Maintenance (O&M) contractor personnel. The major portion of this training will be conducted during the installation phase of the DAS.

8.3 Training Program

Requirements:

8.3.a The training program shall include a definition of the qualifications required by operations and maintenance personnel to meet position description skill requirements.

8.3.b A training plan to define the phasing, methods and techniques for achieving the requisite skill levels, using curricula and course materials for skill/qualification areas within each position description shall be included.

8.3.c Training devices and equipment shall be included.

8.3.d Administrative support to implement the training program shall be included.

8.4 Skill Area Requirements

8.4.1 Operator Training

Requirements:

8.4.1.a Operator training shall cover a DAS network overview.

8.4.1.b Operator training shall cover the DAS concept of operations including key design features.

8.4.1.c Operator training shall cover detailed DAS operational procedures.

8.4.2 Maintenance Technician Training

Requirements:

8.4.2.a Maintenance training for both hardware and software shall cover DAS maintenance concept.

8.4.2.b Maintenance training for both hardware and software shall cover diagnostics and troubleshooting.

8.4.2.c Maintenance training for both hardware and software shall cover detailed repair procedures and techniques including the use of available tools and repair equipment.

8.4.2.d Maintenance training for both hardware and software shall cover DAS software maintenance concepts.

8.4.2.e Software-unique maintenance training shall include debugging techniques and high order language (HOL) use.

8.4.2.f Training shall cover maintenance of both operational and support software.

8.5 Training Devices and Equipment

To the maximum extent practicable, hardware maintenance training should take advantage of equipment, and simulation/automation capabilities provided for day-to-day WSC operations.
Requirements:

8.5.a DAS training devices and equipment for maintenance training shall be specified in the Training Plan.

8.6 Training Support

Requirements:

8.6.a Administrative support for training shall provide for the testing and certification of students.

Section 9. Maintenance Requirements

9.1 Overview

This section contains the detailed maintenance requirements for the WSC. The objective of the maintenance functions is to support achievement of the required inherent availability. General requirements, which directly affect the performance of maintenance functions, include ease of access to equipment for tests and maintenance, the use of built-in test and diagnostic features, and the capability to perform maintenance without interfering with on-going operations.

9.2 Detailed Maintenance Requirements

The WSC has the resources, personnel, and logistics support required to (1) maintain, modify, and repair hardware and (2) maintain modify and enhance software. Hardware maintenance is performed under a formally established system maintenance program that includes both Preventive Maintenance and Corrective Maintenance procedures.

Requirements:

9.2.a Procedures shall be developed using 500-tip-2111, Content Specification for Operation and Maintenance Manuals, as a guideline.

9.2.b Any state-of-the-art techniques that are developed for the DAS shall be included in the procedures.

9.2.1 Hardware Maintenance

Hardware maintenance will be conducted at two levels. First level maintenance is conducted to support the inherent availability requirements by replacement of line replaceable units (LRUs) and line replaceable items within LRUs. Second level maintenance consists of the repair, adjustment, and testing of LRUs removed from service during first level maintenance actions. Attention will be given to GSFC specifications so as to provide for chassis slides, cable service loops, and cable retractors to aid maintenance.

9.2.1.1 Identification of LRU

Requirements:

9.2.1.1.a LRUs shall include rack-mounted equipment drawers and panels and other assemblies that can be removed by unplugging power and signal connectors without physically disturbing other LRUs. Other line replaceable items include printed circuit cards and other plug-in components within an LRU.

9.2.1.2 First Level Maintenance

Requirements:

9.2.1.2.a First level maintenance shall include scheduled preventive maintenance.

9.2.1.2.b First level maintenance shall include fault isolating to the level of an LRU.

9.2.1.2.c Fault isolation to the level of a line replaceable item within an LRU (if any) shall be performed if the time required is consistent with the operational maintainability requirement

9.2.1.2.d First level maintenance shall include replacement of a failed LRU or line replaceable element within an LRU.

9.2.1.2.e First level maintenance shall include testing to ensure that the system/subsystem has been restored to operational condition.

9.2.1.2.f First level maintenance shall include alignment and tuning.

9.2.1.3 Second Level Maintenance

Second level maintenance is conducted to restore malfunctioning equipment to serviceable condition when the failure requires unit/element disassembly. Second level maintenance is also required when the fault isolation capabilities of first level maintenance are incapable of localizing a failure to a line replaceable item within an LRU. Second level maintenance is performed in or under the management control of the Hardware Maintenance Depot.

Requirements:

9.2.1.3.a. Second level maintenance actions shall include localization of a failure to the piece-part or equipment component level, as appropriate. (TBR)

9.2.1.3.b Second level maintenance actions shall include disassembly and removal of the failed piece-part or equipment component.

9.2.1.3.c Second level maintenance actions shall include replacement of failed elements and reassembly.

9.2.1.3.d Second level maintenance actions shall include bench testing to ensure performance to the specified level.

9.2.2 Software Maintenance

Software maintenance, including debugging, modification, and enhancement of system software packages, shall be performed in the SMTF.

Section 10. Spares Provisioning

10.1 Overview

Requirements for spares provisioning are presented for each of the following time periods:

Prior to Acceptance Testing.
After Acceptance Testing.

Requirements:

10.1.a Spares provisioning for the WSC shall be determined and provided by the development contractor through Provisional Acceptance Testing.

10.1.b A series of provisioning conferences shall be supported to develop the spares provisioning program in accordance with STDN 507, Network Logistics Manual.

10.1.c All support spares remaining after Acceptance testing shall be delivered to the WSC site. Prior to Acceptance Testing, the WSC O&M contractor and Logistics Support Depot contractor, under the direction of NASA, will implement the spares provisioning program, replenish the spares to the proper levels, and provide follow-on spares to support the DAS. After Acceptance Testing of the DAS, the WSC O&M contractor will maintain the spares support program primarily through requisitioning from the Logistics Support Depot (LSD). Spare parts provisioning procedures will be coordinated with the Logistics Support Depot contractor (currently responsible for Network provisioning) and the WSC O&M contractor, under the overall direction of NASA. After Acceptance Testing, follow-on provisioning spares will be arranged by the Logistics Support Depot contractor.

10.1.d The information required to develop, implement and maintain operation of this spares provisioning program, consistent with the DAS requirements contained in this Specification and the spares provisioning requirements identified in the following sections, shall be provided.

10.2 Provisioning Conferences

Requirements:

The provisioning conference will be held in the Critical Design Review timeframe. NASA, supported by the WSC O&M contractor and the Logistics Support Depot contractor, will make purchase and stocking decisions based upon the availability and maintainability requirements and demand history/logistics support analysis results.

10.3 Initial Spares Provisioning

Requirements:

10.3.a The initial spares provisioning shall be determined. A spares provisioning formula will not be provided by NASA.

10.3.b The proposed spare parts and quantities shall be based upon satisfying the availability and maintainability requirements of this Specification.

10.4 Replenishment Spares

Replenishment spare parts for the WSC will be procured by NASA supported by the WSC O&M and Logistics Support Depot contractors.

Requirements:

10.4.a Technical data shall be provided to allow for procurement of spare parts directly from the actual manufacturer of the equipment.

10.4.1 Spare Parts Availability

Requirements:

10.4.1.a It shall be ensured that either spare parts are available for a period of 10 years after Final Acceptance Testing or that NASA be provided advance notice of intent to discontinue manufacture of parts/components by all levels of subcontractors.

Section 11. Security

11.1 Overview

The DAS will be installed within the WSC and interconnect with Customers via the SN Web Services Interface (SWSI) and the NASA Integrated Services Network (NISN) Closed Internet Protocol (IP) Operational Network (IOnet) for control and status. The DAS will interconnect with Closed IOnet or dedicated Customer circuits for telemetry delivery.

Requirements:

11.1.a. The DAS shall conform to the requirements and procedures of NASA NPG 2810.1, Security of Information Technology for Mission Information.

11.2 Security Boundary

NPG 2810.1, paragraph 4.2.5.a, establishes the criteria for defining an IT System Security Boundary.

Requirements:

11.2.a. The DAS IT Security Boundary for Customer control and status shall be at the interface to the SWSI. SWSI security implementation is documented in 452-SP-SWSI, Security Plan for SWSI.

11.2.b. The DAS IT Security Boundary for NISN Closed IOnet telemetry delivery shall be at the WSC Closed IOnet interface. NISN Closed IOnet security implementation is documented in 290-003, IP Operational Network (IOnet) Security Plan.

11.2.c. The DAS IT Security Boundary for Internet telemetry delivery shall be at the interface with the NISN Secure Gateway defined in 290-003, IP Operational Network (IOnet) Security Plan.

11.2.d. The DAS Physical Security Boundary shall be within the Category II Limited Areas defined in 530-WSC-0009, WSC Security Manual.

11.3 DAS Interconnection

Requirements:

11.3.a. The DAS connection to the SWSI interface shall be via the Closed IOnet only.

11.3.b. The DAS connection to the NISN Secure Gateway shall be via the Closed IOnet only.

11.4 Access to DAS Data

Requirements

11.4.a. The DAS shall ensure that only specifically authorized Customers have access to their specific Customer data.

11.4.b. The DAS shall control access to DAS data by O&M personnel as defined in 530-WSC-0024, Information Technology Systems Security Plan (ITSSP) for the White Sands Complex.

Abbreviations and Acronyms

Ai	Inherent Availability
AM	Amplitude Modulation
Ao	Operational Availability
AWGN	Additive White Gaussian Noise
BIΦ-L	BI Phase -L
bps	bits per second
CCB	Configuration Control Board
CCSDS	Consultative Committee for Space Network Data Systems
C/No	Carrier-to-Noise Ratio
COTS	Contractor Off The Shelf
CW	Continuous Wave
DAS	Demand Access System
dB	decibel
dBFS	Decibels referenced to Full Scale
dBm	Decibels referenced to one milliwatt
DCN	Document Control Notice
DIDs	Data Item Description
DRL	Data Requirements List
Eb/No	bit energy to noise power spectral density ratio
EMC	Element Multiplexer Correlators
EMI	Electro Magnetic Interference
GRGT	Guam Remote Ground Terminal
GSFC	Goddard Space Flight Center
HOL	Higher Order Language
IBU	Independent Beamformer Units
ICD	Interface Control Document
I/O Net	Input/Output Network

IP	Internet Protocol
IOnet	Internet Protocol (IP) Operational Network (this is a closed network)
kbps	kilobits per second
kb/sec	kilobits per second
kHz	kilo Hertz
KVA	kilo Volts Amp
LCM	Local Control and Monitor
LNA	Low Noise Amplifier
LOPs	Local Operations Procedures
LRUs	Line Replaceable Units
LSD	Logistics Support Depot
MA	Multiple Access
MAR	Multiple Access Return
MHz	Mega Hertz
μsec	microseconds
MIL-HDBK	Military Handbook
MIL-STD	Military Standard
MTBF	Mean Time Between Failure
MTTR	Mean Time To Repair
NASA	National Aeronautics and Space Administration
NISN	NASA Integrated Services Network
NRZ-L, M, S	Non Return to Zero-L, M, S
ns, nsec	nanoseconds
O&M	Operations and Maintenance
PN	Phase Noise
P_E	Probability of Error
RFI	Radio Frequency Interference
QPSK	Quadrature Phase Shift Keying
rms	root mean square
SMTF	Software Maintenance and Test Facility

SN	Space Network
SNIP	Space Network Interoperability PN Codes
SNUG	Space Network Users Guide
SOS	“Save Our Ship”
SPEC	Specification
SQPN	Staggered Quadrature Phase Noise
SRD	System Requirements Document
STDN	Space Flight Tracking and Data Network
STGT	Second TDRSS Ground Terminal
SWSI	Space Network Web Services Interface
TBD/TBR	To Be Determined/To Be Reviewed
TDRS	Tracking and Data Relay Satellite
TDRSS	Tracking and Data Relay Satellite System
TGBFS	Third Generation Beamforming SubSystem
TOCC	TDRSS Operation Control Center (located at WSC)
WSC	White Sands Complex (which consists of STGT, WSGT, and GRGT)
WSGT	White Sands Ground Terminal